PB85-161230

Sulfur Deposition Modeling with the NAPAP Emission Inventory

(U.S.) Environmental Protection Agency
Research Triangle Park, NC

Jan 85

U.S. Department of Commerce
National Technical Information Service
NTIS

PB85-161230

EPA/600/D-85/013
January 1985

SULFUR DEPOSITION MODELING WITH THE NAPAP EMISSION INVENTORY

Terry L. Clark
Atmospheric Sciences Research Laboratory
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

ATMOSPHERIC SCIENCES RESEARCH LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA/600/D-85/013		PB85 161230/AS

4. TITLE AND SUBTITLE	5. REPORT DATE
SULFUR DEPOSITION MODELING WITH THE NAPAP EMISSIONS INVENTORY	January 1985
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
T. L. Clark	
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
(Same as Block 12)	CCVN1A/01-3166 (FY-85)
	11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
Atmospheric Sciences Research Laboratory-RTP, NC Office of Research and Development U.S. Environmental Protection Agency Research Triangle Park, NC 27711	14. SPONSORING AGENCY CODE EPA/600/09

15. SUPPLEMENTARY NOTES

16. ABSTRACT

Version 2.0 of the 1980 NAPAP SO_2 emissions inventory has been selected for use in the International Sulfur Deposition Model Evaluation (ISDME). Appropriate emissions data from this inventory have been processed to create model input files to be used directly by Lagrangian/Eulerian ISDME regional-scale sulfur deposition models. This paper identifies the NAPAP emissions inventory elements useful to these models and summarizes the emissions data processing procedures.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
RELEASE TO THE PUBLIC	UNCLASSIFIED	6
	20. SECURITY CLASS *(This page)*	22. PRICE
	UNCLASSIFIED	

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE

NOTICE

This document has been reviewed in accordance with U.S. Environmental Protection Agency policy and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

SULFUR DEPOSITION MODELING WITH THE NAPAP EMISSION INVENTORY

ABSTRACT

Version 2.0 of the 1980 NAPAP SO_2 emission inventory has been selected for use in the International Sulfur Deposition Model Evaluation (ISDME). Appropriate emission data from this inventory have been processed to create model input files to be used directly by Lagrangian/Eulerian ISDME regional-scale sulfur deposition models. This paper identifies the NAPAP emissions inventory elements useful to these models and summarizes the emissions data processing procedures.

INTRODUCTION

The Environmental Protection Agency and Environment Canada are coordinating the International Sulfur Deposition Model Evaluation (ISDME) as an extension of an earlier model evaluation effort (1). One goal of the current study is to assess model performance and credibility via statistical evaluation of the 1980 seasonal and annual model results from as many as 15 Lagrangian and 2 Eulerian regional-scale sulfur deposition models (2).

The evaluation year of 1980 was selected on the basis of the significant increase in the number of operational precipitation chemistry monitoring sites in eastern North America during that year and the availability of suitable U.S. and Canadian SO_2 emission inventories for that year (3,4).

Before any air pollution model can be applied, point and area source emissions data from an appropriate inventory must be aggregated or processed, usually via a model "preprocessor", to create a more compatible input data file. In an evaluation study involving a group of models, it is essential that one processing algorithm be used to avoid extraneous differences between model results. Therefore, a uniform processing algorithm was developed and applied by Benkovitz (5) to create four sets of seasonal and annual emission grids, any one of which would be compatible with the ISDME models.

NAPAP EMISSION DATA PROCESSING

Essentially ISDME data processing involved extracting appropriate inventory elements (Table 1), apportioning SO_2 emissions to grid cells, and creating model input data grids with configurations required by the ISDME models. Spatial resolution of these grid configurations ranged from 70 to 127 km.

For point sources, as a means of data quality assurance, the inventory source coordinates were screened to determine if indeed the source was located within the designated county. When the coordinates were missing or the inventory source coordinates were located outside a quadrangle whose perimeter was at least 1/2 degree latitude/longitude from any point along the county border, the county centroid coordinates were substituted as a correction. For some states, county centroids were used for over half the point sources (e.g., Iowa, Kansas, Michigan, Nebraska, North Carolina, South Carolina and Wisconsin). These point source location adjustments have been incorporated into subsequent versions of the NAPAP inventory by Engineering Science.

After the source location was established, an annually averaged effective stack height was computed for each point source using the inventory stack parameters and climatological atmospheric stability data. Frequently, the set of stack parameters was incomplete so national average stack parameters for the appropriate SIC were substituted.

Next, the seasonal SO_2 emission rates were determined from percentage annual throughput data and allocated to the proper layer (0 - 200, 201 - 500, and above 500 m) of the grid cells containing the source. Seasons were defined thusly: winter - December, January and February and so forth.

Area source emissions, which were available only on a county basis, were apportioned to grid cells according to the apportionment of 1970 county population based on U. S. Census Bureau data. Emissions from area sources were assumed to be injected in the 0-200 m layer.

Upon completion of the point and area source emissions data processing, a quality assurance program was implemented. As a result, for each grid cell, the sum of the seasonal emissions equalled the annual emissions. In addition, the distribution of ISDME annual emissions compared very well with that of the MOI emission inventory (1,4).

CONCLUSIONS

As a result of the ISDME emission data processing effort, Lagrangian and Eulerian sulfur deposition modelers have at their disposal 1980 seasonal and annual 3-layer SO_2 point source and 1-layer SO_2 area source emissions grids for North America. Four different grid configurations, ranging in resolution from 70 to 127 km, are available.

TABLE 1. ELEMENTS OF THE NAPAP EMISSION INVENTORY APPROPRIATE TO REGIONAL-SCALE SULFUR DEPOSITION MODELING

Element Name	Reason for Need
State Code	Source Identification
County Code	"
Plant Code	"
NEDS Point Code	"
Date of Record	"
SCC Code	Uncertainty Assessment
SIC Code	Emission Apportionment
Point Source Location	"
Percentage Annual Throughput	"
Normal Operating Rate	"
Annual SO_2 Point Source Emission Rate	"
Annual SO_2 Area Source Emission Rate	"
Points with Common Stack	"

REFERENCES

1. U. S./Canadian Memorandum of Intent on Transboundary Air Pollution, Atmospheric Sciences and Analysis Work Group 2, Phase III Final Report. U. S. Environmental Protection Agency, Washington, D. C., 1983.

2. Clark, T. L.; D. H. Coventry; C. M. Benkovitz; E. C. Voldner; and M. Olson. The International Sulfur Deposition Model Evaluation, Phase I, North American Evaluation, Volume I. To be published.

3. Engineering Science. Development of the NAPAP Emission Inventory for the 1980 Base Year. U. S. Environmental Protection Agency Contract No. 68-02-3509. June 1984.

4. U. S./Canadian Memorandum of Intent on Transboundary Air Pollution, Emissions, Costs and Engineering Assessment Work Group 3B, Phase III Final Report. U. S. Environmental Protection Agency, Washington, D. C., 1982.

5. Benkovitz, C. M. Private Communication.